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CRUISE REPORT

VESSEL: *Oscar Elton Sette*, Cruise 03-06 (OES-07)
CRUISE

PERIOD: 12 July-17 August 2003

AREA OF OPERATION: Northwestern Hawaiian Islands (NWHI) (Fig. 1)

TYPE OF OPERATION: Personnel from the Coral Reef Ecosystem Division, Pacific Island Fisheries Science Center (PIFSC), National Marine Fisheries Service (NMFS), NOAA, conducted reef assessment/monitoring and mapping studies in waters surrounding the Northwestern Hawaiian Islands.

ITINERARY:

12 July — Start of cruise. Embarked Ed DeMartini (fish), Mark Albins (fish), Steve Cotton (fish), Jean Kenyon (coral), Greta Aeby (coral), Scott Godwin (invertebrates), Kim Page (algae), Jon Winsley (algae), Joe Laughlin (towboard/fish), Brian Greene (towboard/fish), Joe Chojnacki (towboard/habitat), Molly Timmers (towboard/habitat), Stephani Holzwarth (moorings/tow), Jamie Gove (moorings/tow), Ron Hoeke (moorings/tow), Joyce Miller (mapping/CTD), John Rooney (mapping/CTD), Scott Ferguson (mapping), Marc Lammers (bioacoustics), and Sun He Bak (data manager). The R/V AHI (Acoustic Habitat Investigator) is carried on deck. Departed Snug Harbor at 0922 en route to Nihoa to commence cruise.

13 July — Deployed drifter. Performed conductivity-temperature-depth (CTD) at NIHOA station. Conducted diver emergency orientation and drills.

14 July — Conducted CTD at NECKER station. Arrived at Necker Island. Conducted three benthic and fish rapid ecological assessment (REA) stations and four towed-diver surveys. Recovered and replaced ocean data platform (ODP) and sea surface temperature (SST) buoy and performed four shallow water CTDs. Departed for French Frigate Shoals (FFS). Deployed drifter.

15 July	Performed CTD at FFS station. Arrived at FFS. Conducted three benthic and fish REA stations and four towed-diver surveys. Recovered and replaced CREWS buoy and surface temperature recorder (STR). Transferred supplies to NMFS and Fish and Wildlife Service (FWS) field camps at Tern Island. Conducted one bioacoustics transect.
16 July	Conducted three benthic and fish REA stations and six towed-diver surveys. Recovered and replaced one STR and performed six shallow water CTDs. Conducted five bioacoustics transects and five tethered optical assessment device (TOAD) transects. The ship was notified that the Coral Reef Early Warning System (CREWS) buoy deployed on 15 July was not transmitting data to shore; try to locate problem with system.
17 July	Conducted three benthic and fish REA stations and six towed-diver surveys. Deployed two STRs and performed four shallow water CTDs. Conducted four bioacoustics transects and two TOAD transects. CREWS buoy debugging continued without success.
18 July	Conducted three benthic and fish REA stations and four towed-diver surveys in the vicinity of Tern Island. Removed the new CREWS buoy, replaced it with the one recovered on 15 July, deployed one STR and performed six shallow water CTDs. Conducted two bioacoustics transects, one TOAD transects and one bottom grab. Attempted an EK60 calibration but the current was too high to complete the calibration. Departed for Gardner Pinnacles.
19 July	Performed CTD at GARDNER station. Arrived at Gardner Pinnacles. Conducted three benthic and fish REA stations and two towed-diver surveys. Deployed one STR and performed nine shallow water CTDs. Conducted three TOAD transects. Departed for Maro Reef. Deployed drifter.
20 July	Performed CTD at MARO station. Arrived at Maro Reef. Conducted three benthic and fish REA stations and six towed-diver surveys. Recovered one STR and deployed two STRs and performed five shallow water CTDs. Conducted two bioacoustics transects and one TOAD transect.
21 July	Conducted three benthic and fish REA stations and five towed-diver surveys. Deployed one STR and performed seven shallow water CTDs. Conducted three bioacoustics transects and three TOAD transects.
22 July	Conducted three benthic and fish REA stations and eight towed-diver surveys. Performed two shallow water CTDs. Conducted three bioacoustics transects and four TOAD transects. Rendezvoused with *M/V American Islander*; disembarked Jean Kenyon, and embarked Jake Asher. Departed for Laysan Island.

23 July	Performed CTD at LAYSAN station. Arrived at Laysan Island. Conducted three benthic and fish REA stations and five towed-diver surveys. Recovered and replaced SST and STR and performed eight shallow water CTDs. Departed for Lisianski Island. Deployed drifter.
24 July	Performed CTD at LISIANSKI station. Arrived at Lisianski/Neva Shoals. Conducted three benthic and fish REA stations and five towed-diver surveys. Recovered and replaced SST and deployed Wave and Tide Recorder (WTR). Conducted bottom grab, bioacoustics transect, and three TOAD transects.
25 July	Conducted three benthic and fish REA stations and six towed-diver surveys. Performed nine shallow water CTDs. Conducted four bioacoustics transects and three TOAD transects.
26 July	Conducted three benthic and fish REA stations and four towed-diver surveys. Recovered and replaced SST, deployed WTR and performed three shallow water CTDs. Conducted four bioacoustics transects and four TOAD transects.
27 July	Conducted two bioacoustics transects, CTD and two TOAD transects. Departed for Midway Atoll. Deployed drifter.
28 July	Performed CTD at MIDWAY station. Arrived Midway Atoll. Moor vessel alongside Sand Island tug pier. Conducted three benthic and fish REA stations and four towed-diver surveys. Recovered and replaced SST and four STRs; performed eight shallow water CTDs. Deployed *R/V AHI* along with 300 gallons of diesel fuel. Removed CREWS buoys to the pier for repair while vessel was conducting other operations. Loaded 300 gallons of gasoline. Disembarked Miller and Ferguson to conduct benthic habitat mapping of the banks offshore of the atoll. Holzwarth was chief scientist while Ferguson was on Midway. *R/V AHI* conducted CTD. Departed for Pearl and Hermes Reef.
29 July	Arrived at Pearl and Hermes Reef. Conducted three benthic and fish REA stations and eight towed-diver surveys. Recovered and replaced STR. Performed shipboard CTD. Conducted two bioacoustics transects and three TOAD transects. *R/V AHI* conducted multibeam survey and CTD at Midway Atoll.
30 July	Conducted three benthic REA stations and eight towed-diver surveys. Conducted two fish collection stations. Recovered 1 STR, deployed 2 STRs, and performed 15 shallow water CTDs. Conducted two bioacoustics transects and seven TOAD transects. *R/V AHI* conducted multibeam survey at Midway Atoll.

31 July	Conducted three benthic and fish REA stations and six towed-diver surveys. Deployed STR, refurbished CREWS buoy and performed two shallow water CTDs. Performed shipboard CTD. Conducted three bioacoustics transects and five TOAD transects. *R/V AHI* conducted multibeam survey at Midway Atoll.
1 August	Conducted three benthic REA stations and six towed-diver surveys. Conducted two fish collection stations. Deployed STR and performed 11 shallow water CTDs. Performed shipboard CTD and bottom grab. Conducted five bioacoustics transects and four TOAD transects. *R/V AHI* conducted multibeam survey and CTD at Midway Atoll.
2 August	Conducted three benthic and fish REA stations and seven towed-diver surveys. Recovered and replaced STR and performed nine shallow water CTDs. Conducted two bioacoustics transects and five TOAD transects. Performed two shipboard CTDs, including one at Pearl and Hermes station. Departed for Kure Atoll. *R/V AHI* conducted multibeam survey at Midway Atoll.
3 August	Arrived at Kure Atoll. Conducted three benthic and fish REA stations and five towed-diver surveys. Refurbished CREWS buoy, recovered and replaced two STRs, and deployed WTR. Conducted six TOAD transects. *R/V AHI* conducted multibeam survey and two CTDs at Midway Atoll.
4 August	Conducted four benthic and fish REA stations and six towed-diver surveys. Recovered ODP and deployed WTR; performed 14 shallow water CTDs. Performed shipboard CTD. Conducted four bioacoustics transects and five TOAD transects. *R/V AHI* conducted multibeam survey and CTD at Midway Atoll.
5 August	Conducted two benthic and fish REA stations and two towed-diver surveys. Performed eight shallow water CTDs. Conducted four bioacoustics transects. Performed two shipboard CTDs, including one at KURE station. Deployed drifter. Transited to Midway Atoll and moored at tug pier. Disembarked Hoeke to *M/V American Islander* to supervise CREWS buoy replacement at Kure Atoll. *R/V AHI* conducted multibeam survey and three CTDs at Midway Atoll.
6 August	Conducted three benthic and fish REA stations and six towed-diver surveys. Ship's divers removed line from shaft. Departed from tug pier to work around Midway Atoll. Conducted bioacoustics transect and five TOAD transects. *R/V AHI* conducted multibeam survey and two CTDs.
7 August	Embarked Hoeke upon small-boat transfer from *M/V American Islander*. Conducted three benthic REA stations and four towed-diver surveys. Conducted three fish collection stations. Deployed ODP and performed 11 shallow water CTDs. Performed shipboard CT. Conducted four

	bioacoustics transects and four TOAD transects. *R/V AHI* conducted multibeam survey and two CTDs.
8 August	Conducted two benthic and three fish REA stations and three towed-diver surveys. Performed shipboard CTD and conducted three bioacoustics transects. Moored at Sand Island tug pier. Loaded *R/V AHI* and one repaired CREWS buoy. Embarked Ferguson , Miller, and Appelgate. Ferguson resumed duties as chief scientist. Disembarked DeMartini, Albins, Cotton, Aeby, Page, Winsley, Greene, Chojnacki, Gove, Lammers, and Asher. Departed Midway en route to Saipan.
9-17 August	Transited to Saipan.
18 August	Arrived Saipan.

Table 1: Cruise statistics

CRUISE STATISTICS:

	Nihoa	Necker Island	FFS	Gardner Pinnacles	Maro Reef	Laysan Island	Lisianski Island	Pearl and Hermes Reef	Kure Atoll	Midway Atoll	Totals
Towed Diver Habitat/Fish Surveys	0	4	20	2	19	5	20	35	13	17	135
Fish Rapid Ecological Assessments	0	3	12	3	9	3	12	9	9	9	69
Fish Collection	0	0	0	0	0	0	0	4	0	3	7
Benthic Rapid Ecological Assessments	0	3	12	3	9	3	12	15	9	11	77
SST buoys deployed	0	1	0	0	0	1	2	0	0	1	5
SST buoys recovered	0	1	0	0	0	1	2	0	0	1	5
STR deployed	0	0	5	1	3	1	2	6	2	4	24
STR recovered	0	0	2	0	1	1	2	3	2	4	15
CREWS deployed	0	0	1	0	0	0	0	0	0	0	1
CREWS refurbished	0	0	1	0	1	0	0	1	1	0	4
CREWS recovered	0	0	1	0	0	0	0	0	0	0	1
ODP deployed	0	1	0	0	0	0	0	0	0	1	2
ODP recovered	0	1	0	0	0	0	0	0	1	0	2
WTR deployed	0	0	0	0	0	0	2	0	2	0	4
Shallow water CTDs	0	4	16	9	14	8	20	37	22	19	149
TOAD transects	0	0	8	3	8	0	12	19	11	9	70
Bioacoustics Transects	0	0	12	0	8	0	11	17	8	8	64
Bottom Grabs	0	0	1	0	0	0	1	1	0	0	3
Shipboard CTDs	1	1	1	1	1	1	3	5	3	3	20
Drifters Deployed	1	1	0	1	0	1	2	0	1	0	7
Days of multibeam survey by *R/V AHI*	0	0	0	0	0	0	0	0	0	10	10
CTDs by *R/VAHI*	0	0	0	0	0	0	0	2	6	5	13

MISSIONS AND RESULTS:

A. Begin monitoring the species composition, abundance, percent cover, size distribution, and general health of the fish, corals, other invertebrates, and algae of the shallow water (<35 m) coral reef ecosystems of the NWHI.

1. Monitoring of coral reef habitats of the NWHI was initiated during this cruise. The process was begun prior to departure with the selection of long-term monitoring sites based on a rigorous coverage of the range of habitats present and their representative fish, coral, invertebrates and algae faunas, and the high probability of year-round access to the site. A list of sites was selected and refined during the course of the cruise. Both the fish and benthic survey teams participated in this monitoring effort. The fish team occupied 69 of these stations, and the benthic team occupied 77. At each site a complete fish and benthic survey was conducted on the same 25-m transect lines. The fish surveys were conducted along three transect lines, while the benthic survey used two. The benthic survey covers three components of the reef habitat: coral, non-coral invertebrates, and algae. The actual activities for each survey component are as follows:
    a. Fish: A combination of standard belt transects and stationary point counts were used to ascertain species composition and abundance at all sites surveyed. During the process of these activities additional information was collected that pertains to the incidence of disease in representative groups, population dynamics between congeners, and the documentation of new species records for the Hawaiian Archipelago. Additionally, collections of fish specimens were conducted for research projects focused on larval fish recruitment dynamics and trace element composition and concentration.
    b. Coral: Two consecutive transect lines were videotaped and the video footage was archived for analysis of coral coverage and to provide a record of the benthic habitat condition. The size distribution of coral colonies was enumerated along a 2X25-m belt transect and recorded in one of seven size class categories. In addition to this data, the incidence of bleaching and/or disease was documented through field observations and the collection of specimens.
    c. Invertebrates: A set of representative Cnidarians, Mollusks, Echinoderms and Crustaceans were quantitatively enumerated along two 2X25 belt transects. Next, two 10X25 quadrats centered around two of the 25-m transect lines were enumerated by visual census to account for species not within the 2X25 belt transects. Species that could not be identified in the field were collected and returned to the research vessel for identification. During this process qualitative observations are made concerning overall species abundance and diversity and the presence of rare or endemic species.
    d. Algae: Quantitative enumeration of algae species composition was accomplished through the use of a series of photoquadrats randomly placed along two 25-m transects. All species within each quadrat were collected for positive identification at a later date. In addition to this exercise, species located in the vicinity of the site were collected to generate an overall species

inventory. Finally, qualitative field observations were made concerning the population structure and presence of rare or endemic species.

B. Conduct benthic habitat mapping of the reefs and submerged banks of the NWHI using multibeam sonar surveys, towed-diver habitat surveys, Quester Tangent Corporation (QTC) acoustic seabed classification, towed camera (TOAD) surveys, and bottom grab samples.

1. One hundred thirty-five towed-diver habitat transects were conducted, covering an estimated 216 linear nmi. QTC acoustic seabed classification data were collected much of the time when the ship was in less than 100 m of water; the total coverage of useable data cannot be quantified until the data are processed. Seventy-four TOAD camera deployments were conducted, which resulted in 1,894 still photographs and approximately 33 h of video data. Three bottom grab samples were collected.

2. A multibeam survey was conducted at Midway Atoll. Approximately 73 sq. nmi of seabed surrounding the atoll were mapped. The survey depths ranged from 8 to 240 m with almost complete coverage between depths of 10 to 80 m. Limited areas were also surveyed inside the atoll.

C. Conduct shipboard CTDs to a depth of 500 m and shallow water CTDs from small boats to a depth of ~30 m and run shipboard acoustic Doppler current profiler (ADCP) and bioacoustic surveys around reef ecosystems to examine physical and biological linkages supporting and maintaining these island/atoll ecosystems.

The ship collected 19 CTDs ranging from 17 to 500 m. One hundred fifty-five shallow water CTDs were collected from small boats in depths ranging from 5 to 137 m. Bioacoustic surveys were conducted at six reef ecosystems; these surveys were conducted at varying times of day and night, resulting in 650 km of transects. Collection of ADCP transects in these areas was precluded because the ADCP sonar created acoustic interference with the EK60 sonar being used to collect bioacoustic and QTC data. Because TOAD, QTC and bioacoustic data collection also took all of the available time, ADCP data were only collected during transits between the reef ecosystems.

D. Deploy an array of CREWS buoys, SST buoys, subsurface Ocean Data Platforms, and subsurface temperature recorders to allow remote long-term monitoring of oceanographic and environmental conditions affecting NWHI coral reef ecosystems.

1. Four SST buoys were replaced to extend the continuous temperature records for another year. Thirteen STRs were replaced and 10 other STRs were placed at new sites. One ODP was replaced, one was recovered, and its replacement was installed at a different location. The NWHI oceanographic observing system was augmented by new wave tide recorders at four locations to measure wave heights.

2. Four CREWS buoys were planned for deployment to replace buoys at existing sites. However, these buoys stopped telemetering data ashore a few days after departing Honolulu. The manufacturer was contacted but was unable to resolve the problem remotely. The existing buoys were left in place and their anchoring systems were refurbished to replace worn hardware. At Midway the nonfunctional CREWS buoys were off-loaded and repaired while the *Sette* was at Pearl and Hermes and Kure Atolls. The PIFSC Marine Debris team on the M/V *American Islander* was trained to replace the buoys and conducted that operation on their transit to Honolulu.

E. Deploy array settlement plates at the base of the CREWS, ODP, and SST moorings to examine temporal and spatial variability of benthic settlement along the Hawaiian Archipelago.

Settlement plates were recovered and new plates installed at seven locations. The recovered plates will be analyzed upon their return to Honolulu.

F. Deploy satellite-tracked surface drifters to evaluate the role of ocean currents in larval transport and recruitment along the archipelago.

Six drifters were deployed along the archipelago at sites chosen as likely sources of larval dispersion.

G. A small collection of reef fishes will be collected at French Frigate Shoals, Pearl and Hermes Atoll, and Midway Atoll to examine population differences among species along the archipelago.

A total of 390 samples of damselfish and wrasses were collected for otolith work back ashore after the cruise. The trace element composition of these otoliths of these will be assayed for signatures of the planktonic environment during larval development. Water samples for trace element chemistry were collected on the forereefs of French Frigate Shoals, Pearl and Hermes Atoll, and Midway Atoll. A lagoonal water sample also was collected at Midway.

H. Determine the existence of threats to the health of these coral reef resources from anthropogenic sources, including marine debris.

In addition to the monitoring activities described above, surveys were conducted at each station to quantify and further characterize coral disease. During this survey, evidence of coral disease was found at very low levels at 68.5% of the sites across all regions. The most common disease was *Porites* trematodiasis caused by the digenetic trematode, *Podocotyloides stenometra* (Aeby 1998*).* This disease was widespread (57.5% of the sites) and is known to exclusively affect *Porites* sp. coral. Numerous other conditions were also observed but at much lower frequency of occurrence (1.4% - 16.4% of the sites). The majority of the observed disease signs were distinct from what has been previously described from other coral reef systems. Numbers of colonies affected by *Porites*

trematodiasis were not enumerated, but other types of conditions were found to be present at low levels. The overall average prevalence of disease (# diseased colonies/total # colonies) was estimated at 0.5% (range 0-7.1%). A disease outbreak at one site at French Frigate Shoals resulted in massive tissue on large acroporid table corals.

I. Survey the 100-fathom isobath surrounding Pearl and Hermes Atoll and Kure Atoll using the multibeam sonar onboard the AHI.

Multibeam surveys of the 100-fathom isobath were not conducted because the R/V AHI was not able to be deployed at Pearl and Hermes Atoll and Kure Atoll. Instead a multibeam survey of Midway Atoll was performed as noted above.

J. Survey submerged cultural artifacts in the vicinity of Kure and Pearl and Hermes Atolls and Midway Island as time permits.

As noted above, the planned surveys of Pearl and Hermes Atoll and Kure Atoll could not be conducted. Several submerged cultural artifacts were tentatively located at Midway Atoll.

SCIENTIFIC PERSONNEL:

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Brian Greene, Towboard Team - Fish, JIMAR, UH, PIFSC, CRED
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DATA COLLECTED:

Digital images of diseased coral
Field notes on signs of coral bleaching or disease
Samples of diseased coral for histopathological analysis
Digital images from algal photoquadrats
Algal voucher specimens
Algal field notes of species diversity and relative abundance
Acoustic Doppler Current Profile (ADCP) data
Digital images of the benthic habitat from towboard surveys
Macro-Invertebrate counts from towboard surveys
Quantitative surveys of reef fishes (larger than 50 cm TL) to species level from towboards
Habitat lineation from towboard surveys
Benthic composition estimations from towboard surveys
Videos of the seafloor from TOAD operations
Still Photos of the seafloor from TOAD operations
QTC benthic acoustic signature data
EK60 mid-water acoustic signature data
Conductivity, temperature, and depth (CTD) profiles to 500 m
High-resolution multibeam bathymetry and acoustic imagery data collected at Midway

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Attachments

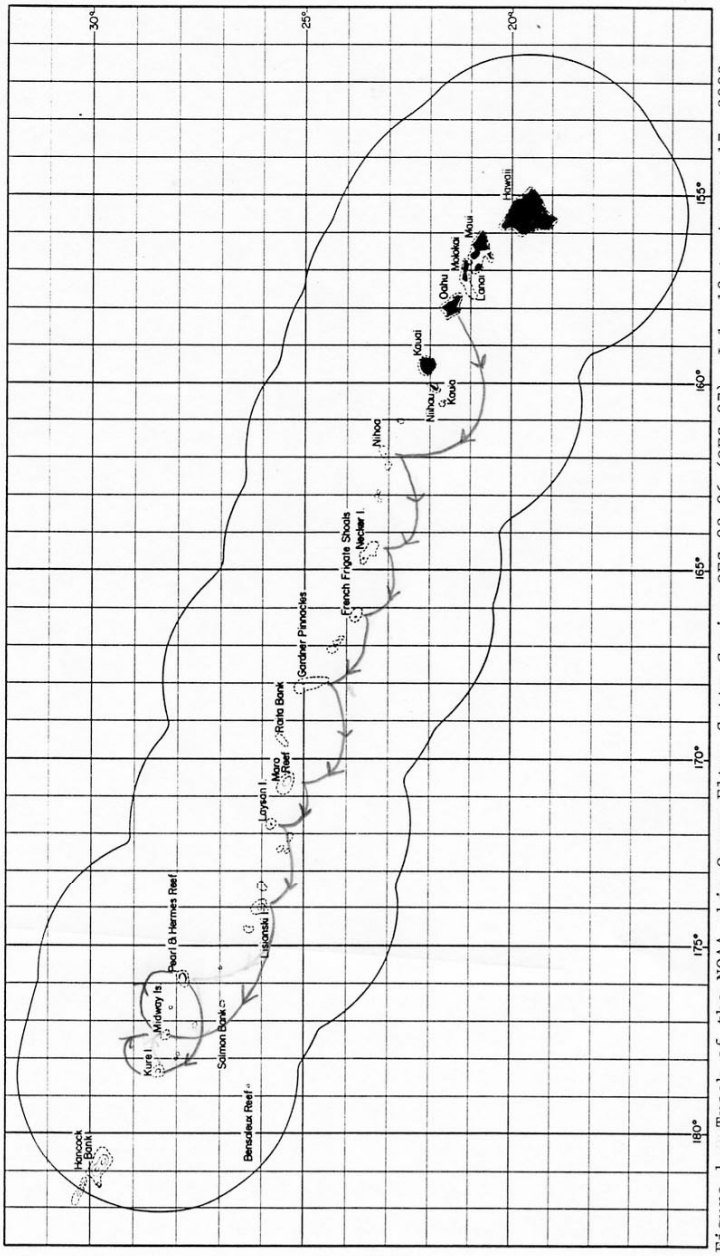

Figure 1.--Track of the NOAA ship Oscar Elton Sette Cruise OES-03-06 (OES-07), July 12 to August 17, 2003.